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Inter-observer variability of intestinal loops delineation after whole pelvis radiotherapy for prostate patients

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Purpose/Objective: At our hospital, a relevant fraction of post-prostatectomy patients (pts) are treated with intensity-modulated whole pelvis radiotherapy (WPRT), leading to the irradiation of an extended area of the intestinal cavity. Bowel loops (BL) need to be contoured and the dose volume histograms (DVH) are evaluated for possible gastrointestinal effects. The aim of this study is to evaluate the inter-observer variability of the bowel volumes obtained by manual contouring, which is still the most used method for this structure.

Materials and Methods: Six experienced observers (1 clinician, 1 radiotherapy technologist, 4 medical physicists) delineated BL contours for three pts enrolled in a multicentric prospectic observational project. The bowel lumen was contoured starting from the most cranial slice where lymph-node planning target volume (PTV) was present. It continued through sigmoid flexure until the rectum contour. Contouring tools included in Eclipse treatment planning system (TPS) were used to manually delineate BL. Contouring differences were quantified in terms of relative volume difference (RD%) and DICE index, that describes the agreement between two delineated contours. Differences between operators were tested with Wilcoxon test.

Results: Mean (± standard deviation, SD) volumes of BL were: (482 ± 54)cc, (681 ± 50)cc (1278 ± 67)cc for pts A-B-C respectively (fig.1). From the point of view of volume variations, BL of the pt A resulted the most difficult to be contoured (11.2%). RD% with respect to average volume values were 17, 2, -11, 3,-14, 4 for each observer respectively. For pt B, RD% were -11, -3, 9, 5, -4 ,4; RD%=(6, -2, 6, -7, -1, -2) for pt C. In summary, observer 5 systematically underestimated the BL volumes with differences of 6.4% on average. This effect is probably due to the contouring habit of observer 5 of being strictly adherent to the bowel lumen and some loops can be missed. Concerning DICE analysis, average DICE values per pairs of observers were assessed. The best agreement was found between observer 1 and 5 (0,86±0.12 ,1SD), while the worst value for observer 4 and 6 (0.73 ±0.04, 1SD). Average DICE for all pair observers were 0.77±0.08, 0.75 ± 0.04 and 0.83±0.04 for pts A, B, C respectively. Differences between pts A-C (p=0.0067) and B-C (p=0,0001) resulted statistically significant.

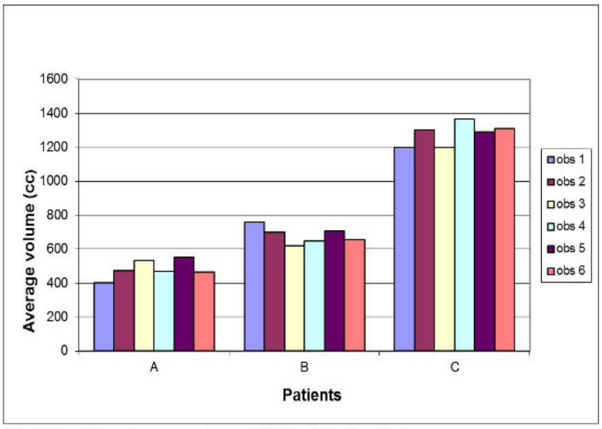

Fig.1: Inter-observer average volume variability for each patient.

Conclusions: Overall inter-observers variations indicated a moderately good agreement in the contouring participants as resulted by DICE values (average values between 0.75 and 0.83).

EP-1628

Commissioning of 18F-FMISO PET-CT circuit to determining the hypoxic tumor volume in lung cancer

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Purpose/Objective: Tumor hypoxia is a factor of resistance of cells to radiation. Knowing the location of these hypoxic zones may allow them to act on selectively modifying the standard treatment guidelines. We describe the method used to determining the hypoxic tumor volume from the point of view of radiotherapy technicians, by planner with rigid fusion, as well as the limitations that we have found.

Materials and Methods: The process is:

• We make a full body 18F-FDG PET-CT scan in which radiopaque markers are placed on the skin of the patient, after, this reference points are tattooed.

• Later we perform 18F-FMISO CT scan and place radiopaque markers on tattoos.

• 4 sets of images are incorporated into Eclipse planner.

• We fuse the 2 CT scans (18F-FDG and 18F-FMISO).

• We determine the areas with 18F-FDG uptake quantitatively (40% maximum SUV) or by semi quantitative algorithm (Source to background) and create FDG uptake volume.

• We determine the areas with 18F-FMISO uptake (ratio tumor / mediastinum) and create FMSIO uptake volume.

• Radiotherapy technician ends the process delimiting organs at risk on 18F-FDG CT scan because is the one used to make the treatment planning.

• The radiation oncologist reviewed and suitable volumes and creates the FDG GTV , the FDG PTV, the FMSIO GTV and the FMISO PTV.

Results: Currently the method is easy and fast to run by technicians (approximately 1 hour and 30 minutes), but the firsts cases have generated to us several problems or concerns as:

• The HYPOXIC areas consists of several very small uptakes spread throughout the tumor.